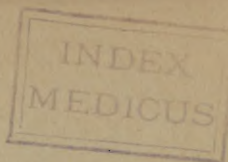


LUNDY (C.J.)



HYPODERMIC MEDICATION

IN

DISEASES OF THE EYE.



BY

CHARLES J. LUNDY, A. M., M. D.,

Prof. of Diseases of the Eye, Ear and Throat,
in the Detroit College of Medicine,

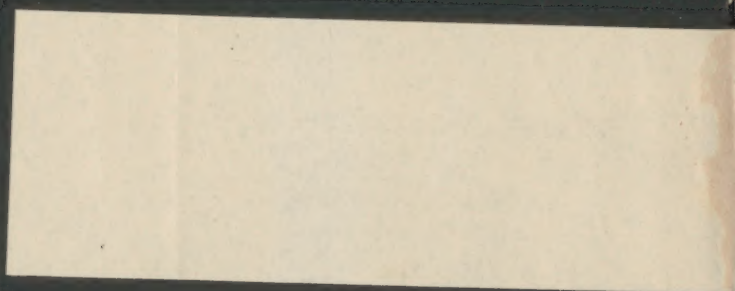
Ophthalmic and Aural Surgeon in Harper Hospital, etc.

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the Author.



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HYPODERMIC MEDICATION

IN DISEASES OF THE EYE.

Hypodermic medication is by no means new to the medical profession. The hypodermic syringe, since its introduction by Alexander Wood, and its improvement by John Hunter, has been used more or less extensively. But within the past decade its use has become more wide spread, and it has been employed in many cases where formerly other means were relied upon.

During the past fifteen years I have used the hypodermic method of medication, either alone or as an adjunct, in the treatment of a large number and variety of cases occurring in my ophthalmic practice. The results in most of these have been eminently satisfactory, and the cases of failure have been few. The total number of injections amounts to several thousand, which were administered either by myself or under my direction by my assistants, Drs. Arnold, Marvin, Campbell and Roller, gentlemen who have been in my employ at different times during the past several years.

In not a single instance has an abscess formed, and discomfort or severe pain has been seldom complained of. In two or three instances where an assistant failed to insert the needle sufficiently deep, slight ulceration of the skin followed. In the main, the injections were deep, or what Dr. Bartholow calls parenchymatous injections, as distinguished from injections made just beneath the skin. The injections were made into the

arms, thighs and gluteal region, and the amount of fluid used at a time rarely equaled half a dram. Large quantities of fluid are more likely to cause pain and discomfort.

The remedies which have been thus employed are strychnine, pilocarpine, ergotin and several salts of mercury, and these have been administered in such diseases as amaurosis, choroiditis with hyalitis, detached retina, and syphilitic affections of the eye, etc.

Amaurosis, or blindness due to the effect of alcohol and tobacco, has long been recognized by the ophthalmic surgeon; but amaurosis due to the excessive use of tobacco alone has been denied by a few. Undoubted cases of tobacco amaurosis, however, have been observed and reported by such authorities as Sir Jonathan Hutchinson, Nettleship, Uhthoff, Alt, Chisholm, Agnew, Noyes, Webster, Berry and many others.

The ophthalmoscopic appearances are not always characteristic in this disease, but central scotoma is usually present, and the color sense is impaired in the vast majority of cases; and these points, together with a knowledge of the patient's habits, will often aid us in making a correct diagnosis.

In tobacco amaurosis Hutchinson says that the nutrient vessels of the optic nerve become smaller and finally disappear, while the retinal vessels may be only slightly altered. In these cases I have never observed the peculiar capillary congestion of the optic disc and retina which is a characteristic of so many cases of chronic alcoholism, and neither have I observed that the atrophic changes are so well marked. Noyes considers that atrophy follows neuritis in these cases, and that the lesion may be at any point between the chiasm and the intra-ocular end of the nerve. The optic disc

is first congested, but the ophthalmic surgeon is not often consulted during this stage. Atrophy follows, with disappearance of the nutrient vessels of the disc.

Sight may be slightly or greatly diminished. Central vision fails first, and the color perception is generally early impaired.

In the treatment of tobacco amaurosis the hypodermic use of strychnia has proven itself of inestimable value. Ophthalmic surgeons have for years relied upon this method of medication, and have considered it superior to all others. My own experience coincides with that of other specialists and bears testimony to the marked benefit to be derived from its use in such cases. Of the several cases which I have seen, the following is one of some interest.

Case 1.—George B., æt. 40, Dresden, Ont., came to consult me October 5th, 1883. For more than a year his sight had been failing, and he could no longer see to read and write, or to shoot with a rifle, a sport to which he was greatly attached.

Vision in right eye equaled $\frac{20}{100}$, in left eye $\frac{20}{200}$. Central vision not so good. Color perception much impaired. Ophthalmoscopic examination showed the media clear and the optic nerve pale and slightly atrophic. His habits were good, except that he was a constant user of tobacco. He used no liquors whatever. My diagnosis was tobacco amaurosis.

Daily injections of strychnia gr. $\frac{1}{20}$ were begun, and the dose was rapidly increased till $\frac{1}{3}$ of a grain of the nitrate of strychnia was given once a day. The use of tobacco was prohibited. The improvement in vision was soon apparent, and went steadily on till vision in the right eye reached $\frac{20}{20}$ or normal, and in the left it was only a little less acute, being $\frac{20}{30}+$. The patient was sent home and given strychnia pills, to be taken for some time. At the end of a year his vision remained good.

Would this patient have regained his sight without treatment, had he simply discontinued the use of tobacco? I think not; at least, my experience has taught me that abstaining from tobacco alone is not

sufficient to effect a cure in advanced cases. Even strychnia does not cure all cases where the sight is very poor, and the disc is much wasted.

In amaurosis depending upon the combined ill effects of alcohol and tobacco, it is a mooted question whether the alcohol or the tobacco is the more active agent in producing the changes to be observed. Chronic alcoholism produces marked changes in other nerve structures, and I am fully persuaded that it also produces certain changes in the optic nerve. In the first stage there is a capillary congestion, and the nutrient vessels of disc are engorged, the larger vessels not being involved to any extent, though the retinal veins are usually full. Later, a pale, slightly wasted appearance of the temporal side of the nerve will be observed, and if the vicious habit is persisted in, the whole of the optic disc becomes more or less pale and atrophied.

Bull, quoting Romiée, says, that the nerve fibres undergo fatty degeneration, accompanied by an increase of connective tissue. Noyes considers that "the pathological lesion is atrophy following inflammation of the axial fibres of the nerve."

The ophthalmoscopic appearances are not always a correct index as to the degree of vision in these cases. Even where very slight atrophic changes have taken place, the vision may be greatly impaired.

Case 2d is an example selected from numerous cases of amaurosis occurring in chronic alcoholism. M. D. M., æt. 43, Alpena, came to consult me October 27th, 1887. On examination media clear, optic nerve showed capillary congestion, on nasal half of disc, while the temporal side of disc showed beginning atrophy. Retinal veins enlarged but not tortuous. Vision in right eye $\frac{1}{100}$, in left eye $\frac{1}{70}$. The central scotoma was here quite apparent for these types could not be seen in central portion of the field. Of course, with such poor vision it was useless to test the color sense. He gave a history of long and free use of whiskey, and the mod-

erate use of tobacco, with the exception of a few months when under the care of another physician, some eight months before he consulted me. The diagnosis was amaurosis from excessive use of alcohol, and treatment was begun accordingly. Free doses of potassium iodide with bitter tonics were given for about three weeks, and hypodermic injections of the nitrate of strychnia were given daily, beginning with $\frac{1}{16}$ of a grain, and increasing the dose gradually to $\frac{1}{8}$ and sometimes to $\frac{1}{4}$ of a grain. Total abstinence from both alcohol and tobacco were rigidly enforced, and in order to accomplish this it was necessary to put the patient in a hospital under guard. Improvement went on rapidly. At the end of three weeks the potassium iodide was discontinued, and galvanism was administered daily. At the end of seven weeks the general appearance of the patient was greatly improved, the optic discs looked more healthy and had lost much of the capillary congestion observed on nasal half of disc when first examined. Vision had increased in a remarkable degree, being $\frac{3}{8}$ in right eye and $\frac{2}{8}$ full in left eye. For the near test, Jaeger No. "1" could be read easily. For a year after dismissal the patient remained well, and so far as known his eye-sight remained good.

This patient had been treated eight months previously for his amaurosis, by the internal use of strychnia, etc. In the hypodermic administration of strychnia, a dose should be given once daily, sufficient to produce the fullest physiological effect of the drug.

In detachments of the retina, I have used the muriate of pilocarpine in several cases. In a majority of these there was some improvement of vision. This was probably due to its beneficial effects in clearing up the cloudiness of the vitreous which so frequently follows the retinal detachment. In the cases of long standing, there was little or no improvement so far as the retinal detachment itself was concerned. I now never use it in such cases. In cases of recent detachment of the retina, however, the hypodermic use of pilocarpine is well worthy a trial, as the following case will show :

Case 3.—Miss A. C., æt. 27, came to consult me September 9th, 1889, complaining of great loss of sight in right eye. She said she had a persistent sensation as if something were waving or floating

in front of her. Ophthalmoscopic examination revealed an extensive detachment of the retina from the temporal side, which caused the sensations described. She was highly myopic. Vision equaled the ability to count fingers at a distance of between one and two feet in the central field; but upon turning the head so that rays of light fell upon the nasal side of retina, vision was much better. Upon careful inquiry it was learned that two weeks before she was thrown from a carriage, striking on right side of head and shoulder. The failure of vision was gradual at first, but it had failed greatly for two or three days previous to consultation. The hypodermic use of pilocarpine was begun at once. The dose administered daily was increased gradually from $\frac{1}{12}$ to $\frac{1}{4}$ of a grain. The latter dose produced free perspiration and flowing of saliva, with disturbance of the heart, giddiness and sense of weakness. The injections were continued daily for about five weeks. At the end of that time vision had increased to $\frac{16}{165}$. Ophthalmoscopic examination at this time showed almost complete restoration of the retina. Vision in right eye had always been poor, and even with correcting glass it was only $\frac{1}{8}$ in the uninjured eye.

Landesberg, of Philadelphia, and others, report gratifying results from the hypodermic use of pilocarpine in intraocular hemorrhage, opacities of the aqueous and vitreous humors in choroiditis and detachment of the retina.

My own experience with hypodermic injections of pilocarpine in choroiditis and vitreous opacities has not been large. Neither have I been so successful in its use as Landesberg and some others. Of the few such cases in which I have used it hypodermically, the case of Mary B., æt. 32, is a fair example. This patient had disseminated choroiditis, with some cloudiness of the vitreous. She had been vigorously treated by another physician who had given her proto-iodide of mercury, the iodide of potash, mercurial inunctions, employed local blood-letting, etc. Vision in right eye $\frac{20}{165}$, and in left, vision $\frac{20}{100}$. Injections of pilocarpine were not well borne, and only $\frac{1}{8}$ of a grain was given once daily. In four weeks vision was $\frac{20}{100}$ in right eye, and $\frac{20}{100}$ in left.

The vitreous had cleared up considerably, retinal congestion had diminished, but there was no appreciable change in the choroidal spots. Improvement did not continue, and the injections were stopped two weeks later.

During the past few years, the treatment of constitutional syphilis by hypodermic injections of mercury has attracted considerable attention. The various salts of mercury, as well as the metal itself, have been employed in this manner; and, as might be suspected, each particular preparation has its own advocate.

I have not seen reports of any cases where the hypodermic injections of mercury were administered in syphilitic affections of the eye; but it is probable such cases have been reported. In the general treatment of syphilis it has been administered hypodermically in all stages of the disease, and in a variety of ways. Lang injects 48 grs. of metallic mercury, at two points, during the same visit, and selects the back as the best point for the insertion. He mixes the mercury with lanolin and olive oil.

Lang does not repeat the dose until after a lapse of from five to eight days. Bender prefers calomel suspended in oil for hypodermic use. Hoffman found abscess to follow five times after 96 injections of calomel. Wilander advocates the hypodermic use of calomel and other insoluble salts of mercury, but admits that he has seen abscess follow their use. Others prefer the albuminate of mercury, some the perchloride, others again the mercuric cyanide.

My own experience with the hypodermic use of mercurials in the treatment of syphilitic affections of the eye, extends over a period of between four and five years. About four years ago I exhibited before this

society some cases in which the hypodermic use of mercury had been employed with marked success.

I have experimented with several salts of mercury, but mainly with the sublimate, the albuminate, the salicylate, and the mercuric cyanide. The sublimate is irritating to most patients, and the albuminate and salicylate are not sufficiently soluble. The cyanide I have found the most satisfactory. Of this I inject daily $\frac{1}{5}$ to $\frac{1}{4}$ of a grain, beginning with a smaller dose. My experience with the hypodermic injection of mercury has been confined, mainly, to its use in ophthalmic practice. I have treated thus a considerable number of patients, exhibiting a variety of affections, occurring both in secondary and tertiary periods. These have embraced diseases of the optic nerve and retina, paralysis of the ocular muscles, inflammations of the uveal tract, including the iris, ciliary body and choroid, vitreous humor, and also gummy tumors of the iris, with iritis, etc., etc. In the majority of these cases, other remedies or modes of treatment had been tried by others or by myself, so that it was an easy matter to make comparisons as to the effectiveness of the hypodermic injections. In only one case did the hypodermic method prove less effective than others, and that was a case of iritis. In one case of choroiditis the improvement was as great as, but no greater than when remedies were administered by the mouth. In all other cases, the hypodermic medication proved itself superior to any and all others. It should be stated, however, that local treatment was also given in many of these cases, for example, in all cases of iritis and irido-cyclitis, atropia, hyoscine, etc., were freely employed, and in many other cases, other remedies were administered when indicated. The following cases are cited as illustrations of the facts here given :

Case 5.—Mrs. S. E., æt. 36, was brought to me September 9th, 1886. She gave a history of having contracted syphilis three years before. Although she had received treatment with mercurials and iodide of potash for the major part of that time, she developed an unusual number of syphilitic lesions, such as papillary and squamous syphilide, sore throat, falling out of the hair, iritis, etc. Seven months before consulting me she began to suffer from attacks of vertigo, nausea and vomiting. A month later she had a paralytic stroke. The left arm and the left side of the face were paralyzed, from which she had nearly recovered. Three months later she began to experience difficulty in coördinating her movements, which difficulty continued to date of examination. The patient was unable to stand or walk unaided. In the right eye, old pupillary membrane from iritis, paralysis of external rectus muscle. In the left eye complete paralysis of all the muscles except the superior oblique. Optic neuritis in left eye, which probably also existed in right, but on account of the pupillary obstruction no satisfactory ophthalmoscopic examination could be made. Memory and intellect were also somewhat impaired.

Treatment with large doses of iodide of potash was begun, together with mercurial inunctions at bed-time. Patient made slight improvement, but the iodide of potash produced such distressing symptoms that it was necessary to abandon it. The mercurial inunctions were ordered continued night and morning, with but little apparent benefit. Having had good results from hypodermic injections of mercury in previous cases, I began their use in this case. The beneficial effects were soon made manifest. The salt employed was the perchloride of mercury, and the beginning dose was $\frac{1}{2}$ of a grain, which was increased to $\frac{1}{3}$ of a grain. Improvement, both in the condition of the eyes and the general condition, went steadily and rapidly on. At the end of four weeks after the first injection the optic neuritis was almost entirely cured, and the muscular control of the left eyeball had in part returned. The paralysis of the sixth nerve of the right eye had disappeared, and the patient could walk quite well, although there was still some lack of coördinating power. The use of the Faradic current to the eye muscles was begun and the injections were continued. The patient improved daily, grew strong and increased in weight, and the paralyzed eye muscles one by one regained their normal power, except the external rectus of the left eye, which remained a trifle weak, although it had been first to show improvement, so much so that for several

weeks the left eye squinted outward. With the exception of the slight defect in the external rectus muscle of the left eye referred to, the case terminated in complete recovery, and whereas she was unable to stand or walk alone at the beginning of treatment, she was eventually able to walk several miles without fatigue.

Case 6.—Irido-cyclitis with gumma of the iris and ciliary body. Mrs. C., æt. 35, consulted me March 12th, 1889. She gave a history clearly syphilitic, and for this she had had long periods of treatment. Three months previous her left eye reddened up and became painful, but the trouble soon subsided, leaving vision impaired. Seven weeks before I saw her, her left eye again became congested, painful and inflamed, and the attending physician called in a specialist, and the two physicians had her continually under their care until I saw her. She presented the following conditions: Great emaciation and prostration; she seemed a physical wreck, and with difficulty could stand or walk alone. Left eye intensely congested, a large gumma half filled the anterior chamber, the origin of which was in the upper and outer quadrant of the iris. It involved the ciliary body, and there was distinct bulging in the ciliary region at that point. The eye was totally blind, and had been for some weeks. There was no perception of light. The diagnosis was syphilitic irido-cyclitis with gummy tumor of the iris and ciliary body. Right eye was normal, but showed symptoms of sympathetic irritation. There was also extensive ulceration of the throat. To relieve the intense pain of her eye she had taken morphine several times a day, and although it had some influence upon her pain, it produced great gastric disturbance. On this, as well as on other accounts, I decided to try the hypodermic injections of mercury, and until such time as the full dose, $\frac{1}{4}$ gr., was given, she was also to use inunctions of the oleate of mercury at bed-time. The inunctions were discontinued after a few days. The mercuric cyanide was injected daily and the dose rapidly increased to $\frac{1}{4}$ of a grain. Savory and Moore's pancreatic emulsion was ordered, with beef essence, milk punch and a generally nutritious diet. Atropia and cocaine were dropped into the eye several times daily. The patient's general condition improved rapidly and the pain in the eye became less intense. On the fourth day a large portion of the gumma sloughed off and seemingly filled the anterior chamber with a dirty, yellowish-gray mass. This quickly underwent absorption and the gumma diminished rapidly. On March 28th, sixteen days after the first visit, she had almost completely

recovered from the severe irido-cyclitis, and the gumma had entirely disappeared. At intervals now the hypodermic injections were suspended for one, two or three days at a time, when she complained of stiffness or soreness of the muscles. During such periods she was given the iodides in small doses, or, when the stomach did not tolerate the iodides, mercurial inunction was employed. At the end of a month, all signs of inflammation having disappeared from the eye, the hypodermic injections were discontinued. She was ordered small doses of the iodide of sodium, which were alternated with proto-iodide of mercury pills, and occasionally all treatment was suspended for periods of two or three weeks at a time.

Occlusion of the pupil having resulted from the severe inflammation, I deemed it advisable to make an iridectomy for artificial pupil. On July 16th I made an upward iridectomy, which gave her very good vision. But my notes do not give the visual acuity.

Why were not other modes of medication used, it may be asked? Because they had been long and vigorously used before she came under my care, and the result was a most pitiable failure. The patient's eye was in imminent danger of being destroyed, and the most effective means at my disposal were absolutely demanded. In concluding the notes of this case, I would say that the tension of the eyeball was above normal until all signs of the gumma had dissappeared. This, I have found to be true in all cases of large gummy tumor involving the ciliary border of the iris.

Case 7.—A. M., æt. 53, consulted me in November, 1887, for an affection of his ear. At that time it was noticed that his eyes seemed weak and lachrymose, but as the patient did not complain of his eyes, nothing was said regarding them. February 4th, 1888, he came complaining that his eyes troubled him, and that his sight was greatly impaired. On examination the following conditions were noted: Right eye, marked ciliary congestion, lachrymation and dread of light, vitreous, hazy, and full of floating bodies. Left eye, intense ciliary congestion, profuse lachrymation, great pain and tenderness on pressure, pupil contracted and irresponsive to light, discoloration and congestion of the iris, with posterior synechia, vitreous cloudy, and filled with floating bodies. No

satisfactory view of the fundus could be obtained in either eye. Vision, right eye $\frac{1}{8}$, and left eye, perception of shadows, barely. Diagnosis, irido-choroiditis, with hyalitis. The patient had suffered from several attacks of rheumatism, and while there was also evidence of syphilis, the eye trouble was thought to be rheumatic in origin. He had been previously treated for rheumatism, but never with satisfactory results. In addition to local treatment with atropia and cocaine, I ordered salicylate of soda, in 15 gr. doses, to be taken steadily till the full physiological effects of the drug were produced. This was continued for four days. While the salicylate relieved his pain to some extent, the results were far from satisfactory. A saturated solution of iodide of potash was then prescribed, of which the patient took 25 drops, well diluted, three times daily, the dose to be increased to 50 drops three times daily. In addition to this, mercurial inunctions were ordered night and morning. On March 4th, twenty-nine days after beginning treatment, the eyes were practically in the same condition as on date of first consultation, except that the pupils were widely dilated, and the posterior synechiae in left eye were broken up. There was no improvement in vision, the eyes remained red, but a little less painful. Hypodermic injection of the cyanide of mercury was then begun, and the dose, given once daily, was increased from $\frac{1}{2}$ to $\frac{1}{4}$ of a grain. March 7th, marked improvement in every respect. March 10th, ciliary congestion greatly diminished, and pain entirely gone. March 20th, vision shows improvement for the first time. March 27th, external appearance of the eye perfectly normal, and no indication of any inflammatory trouble, except upon ophthalmoscopic examination. Ophthalmoscope shows vitreous still cloudy, with many floating bodies. From this time on, vision improved steadily and rapidly, until it became normal in the right eye, and $\frac{1}{10}$ in the left. The cloudiness of vitreous in left eye still remains. This patient was given about 60 injections. His rheumatism was entirely cured.

Case 8.—Syphilitic iritis. August Q., æt. 50, consulted me January 11th, 1889. For two or three days eyes have been irritable, which patient attributes to reading late at night. Some congestion of conjunctiva, especially of right eye. Pupils responsive to light. Vision $\frac{2}{20}$, or normal. After instilling a few drops of homatropia in right eye, the pupil dilated readily and *ad maximum*. Ophthalmoscope showed media clear and slight retinal hyperæmia. Next day patient complained of lancinating pains in right eye. Atropia was instilled, and the patient was directed to return next day. He did not return, however, for 48 hours. January 14th,

right eye showed ciliary congestion, pupil not responsive to light, and does not dilate readily under the use of atropia. Proto-iodide of mercury, gr. $\frac{1}{4}$, three times daily, and also mercurial inunctions were ordered, also the free use of atropia. January 16th, pupil contracted, despite the free use of atropia, aqueous humor, cloudy, vision greatly impaired and considerable pain. January 17th, eye much worse. Pupil greatly contracted and filled with lymph, intense ciliary congestion, severe pain, no reflex from fundus of eye, and vision reduced to perception of shadows. Iodide of potash in large doses was substituted for the proto-iodide of mercury, and the inunctions and atropia were continued, and leeches were applied to temple. January 18th the patient passed a wretched, sleepless night, and feels much depressed over the loss of sight in right eye, which is now complete, there being no light perception. Treatment continued without change. January 20th conditions remained the same. Hypodermic injections of the mercuric cyanide, gr. $\frac{1}{4}$, were begun, and the iodide was discontinued. January 23d some improvement is manifest, less pain, and patient sees light. January 26th improvement well marked, aqueous humor less cloudy, lymph absorbing and some red reflex from fundus of eye, patient can count fingers.

From this time on improvement was rapid. Within two weeks from this date nearly all evidences of the severe inflammation had disappeared, the injections were discontinued, and patient came irregularly. About this time he spent several hours driving a horse and cutter in a sharp wind, and the exposure brought on a slight relapse, which yielded to treatment within two or three days. On February 15th he was dismissed cured, with vision $\frac{3}{80}+$.

My experience with hypodermic medication in inherited specific keratitis has not been extensive, and my success with it has not been so flattering as in most other cases.

Case 9.—T. M., æt. 18, a strong, vigorous man, was referred to me by Dr. Chittick, and from the Doctor a distinct syphilitic family history was obtained. Left eye, profuse lachrymation, cornea greatly infiltrated and vascular, great ciliary congestion, ciliary neuralgia, and vision reduced to perception of shadows. The disease was of several weeks standing, and during most of this time he received from another specialist treatment, which consisted in the main of potassium iodide and locally atropia. I ordered atropia and hyoscine locally, and the iodides were given in large doses.

There was little or no improvement for some weeks, and I began the hypodermic use of the mercuric cyanide. While the improvement was still slow, it was more satisfactory. Early in August the right eye became affected and grew slowly worse, despite the treatment. On August 19th five leeches were applied to right temple. On September 14th both eyes greatly improved, the right one improving most rapidly. The hypodermic injections were now discontinued. The mydriatic was kept up, and at intervals the iodides or proto-iodide of mercury pills were given. Improvement continued, and patient regained a fair degree of vision. On April 14th I saw the patient, after a lapse of several months, he having spent a good portion of it in the South, and on examination vision in right eye with $-\frac{1}{20}$ s = $\frac{20}{40}$, and in left eye $\frac{20}{80}$.

The advantages of hypodermic medication over other methods are probably due to several causes, and its use under proper limitations may be commended upon the following grounds:

First—The medicine does not escape through some natural channel before it has entered the circulation, as is so often the case when medicines are administered by the mouth.

Second—The dose can be regulated with greater accuracy, and the action of the drug is more certain.

Third—The full physiological effect can be gotten almost instantly, because the remedy is more quickly diffused through the system, and with drugs like strychnine, pilocarpine, etc., this is most important.

Fourth—In some instances, results can be obtained by the hypodermic method which can not be obtained otherwise.

Fifth—I have never seen ptialism follow the hypodermic use of mercury.

Sixth—When medicines are not well borne, or when they produce unpleasant symptoms, hypodermic medication in appropriate cases will meet every indication, and will often prove itself superior to other methods.

